Executive Summary

A review of Task Assignment 94-4 identifies a number of areas where additional information would be very useful. A major theme in this review is the extent to which an increase in the MTTRes is a qualitative rather than merely quantitative change. Another issue concerns the ability of various facilities to accept new data while simultaneously processing older data. A number of other technical issues and questions are raised on topics not adequately explained in the TRW study report. Finally, a number of details concerning the cost analysis are missing and, therefore, the total cost cannot be verified.

In the Conclusions, the parts of the Task Assignment that were not addressed sufficiently are summarized. Some of the assumptions are questioned and missing impacts on requirements are noted. The derivation of some of the answers could not be validated because some of the relevant information was not presented. An additional topic for study is suggested. In short, it does not appear that there is enough detail to verify many of the conclusions and it would be difficult, on this basis, for NASA to make a decision.

1.0   CUP REPORT 94-4 REVIEW

1.1   Background

The text for Task Assignment 94-4 reads as follows:

Analyze Impacts of Ecom Mean Time to Restore Change

The contractor shall assess the impacts to EDOS of changing the Ecom mean time to restore (MTTRes) service from 1 hour to 4 hours. These impacts shall be analyzed against both the baseline system and the consolidated system developed under Task Number 94-2. This analysis shall identify impacts to the baseline EDOS architecture, existing external and internal interfaces, changes to the negotiated baseline functions in terms of effort, material, and ODC. The contractor shall document the impacts on the existing EDOS operations concept and provide projections on required operations staff.

The results of Task Order 94-4 are contained in a report (TRW 2700 94-4.00 Rev 1) dated November 4, 1994. The page numbers in the comments below refer mostly to this document, although there is one reference to an earlier presentation (TRW 2900-A104.99) dated 10/23/94.

1.2   Objective

This document presents an engineering analysis of TRW Task Assignment 94-4 on the impacts from an increase in the Ecom Mean Time to Restore (MTTRes).   This analysis does not constitute a cost or technical audit of the TRW study.   The objective of this analysis is to answer the following questions:

1. Does the study address all elements of the task SOW?   Do they answer all the questions?

2. Are the assumptions reasonable?

3. Does the study identify all of the technical and cost impacts?

4. Does the study consider requirement changes that would be appropriate?

5. Are the answers valid? Can the derivation of the answers be validated?

6. Should the study have addressed additional or different topics?

7. Does the study provide an adequate basis for NASA to make a selection?

1.3   Analysis

This analysis of TRW   study report 94-4 is organized to correspond to the Task Assignment.

(a)   The contractor shall assess the impacts to EDOS of changing the Ecom mean time to restore (MTTRes) service from 1 hour to 4 hours.

- Since the baseline must include code to handle one-hour outages, handling four-hour outages should be manageable by changing some parameters or table values. The change from one hour to four hours is one of degree, not of kind. Therefore it is not clear why the increase in outage time warrants a large amount of additional code. (This is a recurring theme in these comments. If this can be explained, a number of comments below can be ignored.)
- The maximum DIF recovery time for a Link B outage is given as 110 minutes (p. 15). During the 110-minute recovery time, is both new and backlogged data being delivered to DPF? If only stored data are being delivered, is new data being stored for later delivery? Was this taken into account in the estimate of 110 minutes?
- When Link D is down, how long can DPF continue to ingest files from the DIF and continue to process data before DPF storage fills up? How does DIF react to this condition?
- How long is the outage where an "extended Ecom outage" is discussed (p. 22, 29)?
- Page 23 has the statement, "Users will not receive data during outage period." However, some backlogged data could be received. For example, while Link B is down, current DPF processing will continue and users will receive data.
- Page 32 has the statement that during the four-hour outage, operations monitoring will not be performed. However, since some operations may continue during the outage, some operations monitoring may be in order.
- For some of the functions, it is not obvious why additional software would be required (p. 38 et seq.). For example, why would a longer outage require Line Outage Monitoring to change? Why would Data Storage Monitoring have to change other than the resetting of relevant parameters?
- Are table-driven recovery procedures part of the baseline plan with one-hour recovery times?

(b)   These impacts shall be analyzed against both the baseline system and the consolidated system developed under Task Number 94-2.

- It is not clear why only non-real-time data was included in the study. One would expect that a change in MTTRes would have an impact on the real-time data. It is also not clear which data is considered to be "real-time."
- As a practical matter, the recovery time includes both the time to restore service and the time to catch up with the backlog created by the outage. Therefore, it seems strange that the DIF recovery time after a Link B outage is stated to be exactly the same as the CPF recovery time after a Link C or D outage — both 110 minutes. In the former case, production data processing still needs to be done; in the latter case the queued data sets simply need to be delivered to the customers.
- What is the impact on RIF's operations when the outage has ended and four hours of stored data need to be processed?

(c)   This analysis shall identify impacts to the baseline EDOS architecture, existing external interfaces,

- There was no description of how a change in MTTRes would affect availability of other EOS services. Will all EOS availability requirements still be met?
- What kind and how many tapes are needed for a four-hour outage in the RIF data thread?
- Since the RIF recovery time is given as the same 110 minutes as for the DIF, it appears that the time for RIF tape i/o has not been taken into account.
- Also on p. 23 is the statement, "Transfer of data to users will initiate as soon as Ecom is restored." But if, for example, the outage was on Link B, the end users will not get data the instant Ecom is restored — the data first have to be processed in DPF.
- On p. 25 is the statement, "Users will not receive Quicklook data during outage period." However, backlogged data can still get to users if it passed the Ecom failure point before the failure occurred.
- On p. 26 and 50, what is meant by "marginal"?
- The computers that scientists at DAACs will be using for their analysis are not the same ones that handle data receipt from DPF. Therefore it is not clear why it is advantageous to deliver data during nights and weekends (p. 28).

(d)   internal interfaces,

- On p. 45, "Internal Interfaces": Why would there have to be "more complex coordination and data management"? Why does "extended latency" cause impacts since functionality for receipt, processing, analysis, and data delivery would need to be in place even for the baseline one-hour outages?
- It is not clear why the longer outage makes coordination and scheduling more complex (p. 45, 46).

(e)   changes to the negotiated baseline functions in terms of effort, material, and ODC.

- On p. 44, "37500" SLOC should be 3750.
- Since p. 44 shows the total SLOC as 21150, was the value of 21500 on p. 38 a misprint? Which value was used in the cost analysis?
- Are the costs on p. 49 actually given in $K instead of $? Similarly, are the costs on p. 52 actually in $M rather than $K? That would make the costs much closer to (although somewhat greater than) the costs given in the 10/23/94 presentation (TRW 2900-A104.99).
- Since the software impact is the same for all architectures (p. 38), it seems that the cost differences for the different options on p. 49 are due mostly to hardware costs. It would be useful to see a separate cost breakdown for hardware and software. Without this information, it is not clear that the costs are reasonable for 21K SLOC.
- ODCs are not detailed at all even though they are requested in the Task Assignment.
- There are small cost discrepancies between p. 49 and p. 52. Why are the costs on p. 49 (except for the baseline architecture with TRDSS) approximately $1K more than on p. 52?

(f)   The contractor shall document the impacts on the existing EDOS operations concept and provide projections on required operations staff.

- Also on p. 32 are statements to the effect that hardware maintenance, problem resolution, and trouble-shooting support will not be available.   Is the implication that an Ecom outage will require all available EDOS hardware maintenance and trouble-shooting support?
- What plans are there for Library and History Data Operations to catch up with the backlog after an Ecom outage?

1.4   Conclusions

1. Does the study address all elements of the task SOW? Do they answer all the questions?

Assignment	More information needed?
Assess the impact of changing Ecom MTTRes for both the baseline system and the consolidated system	Some details (see comments above)
Identify impacts to (a) architecture (b) existing internal and external interfaces (c) baseline functions with respect to effort, material, and ODC	(a) No (b) No (c) Yes: Cost not broken down by effort and material; ODCs not detailed
Identify impacts to the Operations Concept and staffing	No

2. Are the assumptions reasonable?

    It is not clear what was assumed concerning the ability of one segment to ingest new data while simultaneously processing older (backlogged) data..

3. Does the study identify all of the technical and cost impacts?

    The technical impacts were addressed within the constraints of the assumptions. The costs were not broken down by effort and material. ODCs were not discussed.

4. Does the study consider requirement changes that would be appropriate?

    It was not clear that the impact on all EOS availability requirements had been sufficiently assessed. If this is considered, it may be that some requirements changes could be warranted.

5. Are the answers valid? Can the derivation of the answers be validated?

    For some functions, it was not possible to verify that the SLOC estimates are reasonable. Similarly, there was not sufficient information to verify the cost estimates.

6. Should the study have addressed additional or different topics?

    An increased MTTRes should allow some requirements for Ecom to be relaxed, leading to lower Ecom costs. Presumably, the higher EDOS costs will be weighed against the lower Ecom costs. That analysis was not part of Task Assignment 94-4 but would be worthwhile to pursue.

7. Does the study provide an adequate basis for NASA to make a selection?

    The study does not provide sufficient detail to verify many of the conclusions. Questions need to be answered and additional information must be provided before an informed decision can be made.